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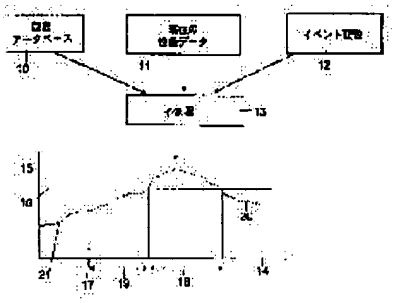
(54) COMMUNICATION NETWORK MANAGING METHOD AND COMPUTER SYSTEM FOR COMMUNICATION NETWORK MANAGEMENT

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a method and a device for managing at least one part of a communication network, especially to provide a method and a device, for example, for performing the network management of a client within an asynchronous transfer mode(ATM) communication network.
SOLUTION: A predictor 13 is used for predicting the parameter of the bandwidth level or the like and for predicting the time when the parameter exceeds a capacity or a previous contract threshold value. These contract levels can be set by service level contract between a service provider and a client, for example. Moreover, the predictor 13 predicts how much excess amount is generated and how long such a condition continues as well. This information is supplied to the service provider/client and supplied to an agent provided with a computer system also. The agent performs negotiation with the other agent to act for the service provider in place of the client, so that new contract conditions can be provided between the two.



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CLAIMS

[redacted]

[Claim(s)]

[Claim 1] (i) -- a communication-network-management method characterized by including a step which predicts a future value of two or more sequences of time series of data about a communication network, has compared a value with at least one threshold since (ii) each **, and achieves results.

[Claim 2] It is the communication-network-management method which said step (i) about :prediction inputs two or more values of (i) time series into a neural network, and is characterized by including further a step which obtains an output including a time series prediction future value from the (ii) neural network in a method according to claim 1.

[Claim 3] It is the communication-network-management method characterized by said step (i) about :input containing a step which inputs information about time amount into a neural network further in a method according to claim 2.

[Claim 4] It is the communication-network-management method characterized by information about the :aforementioned time amount including information about a current time in a method according to claim 3.

[Claim 5] Information concerning [on a method according to claim 3 and] the :aforementioned time amount is the communication-network-management method characterized by being inputted into a neural network in a form of at least one pair of values about an angle.

[Claim 6] It is the communication-network-management method characterized by a value of the :aforementioned pair containing a sign and cosine of said angle in a method according to claim 5.

[Claim 7] A communication-network-management method characterized by including further a step which inputs said a part of output [at least] from the neural network into :neural network in a method according to claim 3.

[Claim 8] A communication-network-management method characterized by including further a step which inputs an attached variable beyond :1 into a neural network in a method according to claim 3.

[Claim 9] It is the communication-network-management method characterized by a value of time series of the :aforementioned data being a single variate in a method according to claim 1.

[Claim 10] It is the communication-network-management method characterized by time series of the :aforementioned data including information about traffic level in a communication network in a method according to claim 1.

[Claim 11] A communication-network-management method characterized by time series of the :aforementioned data including information about bandwidth level of a communication network in a method according to claim 1.

[Claim 12] It is the communication-network-management method characterized by the :aforementioned communication network containing an Asynchronous Transfer Mode communication network in a method according to claim 1.

[Claim 13] It is the communication-network-management method characterized by the :aforementioned communication network containing a virtual private network in a method according to claim 1.

[Claim 14] Said computer system is the communication-network-management method characterized by being arranged so that a comparison result may be accepted, and including a threshold, criteria of a lot, and information about action of a lot further including computer system with which, as for each agent, the :aforementioned communication network supplies at least one communication link to other agents including at least two agents in a method according to claim 1.

[Claim 15] A communication-network-management method characterized by including further a step which uses :(i) agent in a method according to claim 14, determines the 2nd threshold based on a group of a comparison result, the 1st threshold, and each agent's criteria, and a group of action, and replaces the 1st threshold of (ii), and the 2nd threshold.

[Claim 16] A group of at least one agent's criteria and a group of action are the communication-network-management method characterized by relating the :aforementioned communication network with a virtual private network including a virtual private network in a method according to claim 14.

[Claim 17] a method according to claim 16 -- setting -- : -- a communication-network-management method characterized by relating a group of at least one agent's criteria, and a group of action with the communication network.

[Claim 18] (i) -- computer system for communication network management characterized by including a comparator arranged in a value prediction machine; arranged so that a future value of two or more sequences of time series of data about a communication network may be predicted, and since (ii) each ** so that results may be achieved as compared with at least one threshold.

[Claim 19] It is the computer system for communication network management characterized by the :aforementioned communication network containing at least two agents in computer system according to claim 18.

[Claim 20] (i) -- computer system for managing some communication networks [at least] -- containing --; -- a prediction machine arranged so that said computer system may predict a future value of two or more sequences of time series of data about the (i) communication network, and;

(ii) -- a communication network characterized by including a comparator arranged so that a value may be compared with at least 1 threshold since each ** and results may be achieved.

[redacted]

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] This invention relates to the communication-network-management method and the computer system for communication network management which manage a customer's network in details more about the communication-network-management method for managing some communication networks [at least], and the computer system for communication network management.

[0002]

[Description of the Prior Art] The customer who uses a service provider's network in large quantities often uses a "virtual private network." A customer can control a part of a service provider's network by this under criteria like "service level criteria." Service level criteria set up typically other elements like the bandwidth level and the quality element with which use by the customer is permitted. When a customer exceeds this bandwidth level in any times, data "is canceled" as a matter of fact.

[0003]

[Problem(s) to be Solved by the Invention] However, when needed, in order to negotiate for bigger bandwidth, it is very difficult for a customer to predict bandwidth requirements in advance. Moreover, a forfeit may be charged, when a service provider assigns an additional resource and performs excess authorization of criteria bandwidth level.

[0004] When a customer exceeds criteria bandwidth level, similarly a problem arises in a service provider. A service provider determines whether assign a customer an additional resource, and it is possible for him or he has to judge the implementation method. Moreover, the decision must be carried out if a decision is made. Therefore, in order to investigate which bandwidth is usable, it is accompanied by analysis of a communication network. Since it is dependent on the effect on the quota resource to many factors, for example, costs, and other customers, the quota possibility to the customer of additional bandwidth, etc., these decision is complicated.

[0005] Since various customers have various priorities and demands, it is difficult to develop the general-purpose method of customer network administration. Moreover, since the customer itself is demanding use of the original network administration method, simple and use must be easy for a method.

[0006] Therefore, the purpose of this invention is to offer the communication-network-management method for managing some communication networks [at least], and the computer system for communication network management, and is more to offer the computer system used for conquest, the customer network administration method mitigated at least, and it or more in one of the above-mentioned troubles at details.

[0007]

[Means for Solving the Problem] according to invention of the 1st of this invention, this invention predicts a future value of two or more sequences of time series of data about the (i) communication network, and it is constituted so that a value may be compared with at least one threshold since (ii) each ** and results may be achieved.

[0008] according to invention of the 2nd of this invention, this invention is constituted so that a prediction machine arranged so that a future value of two or more sequences of time series of data about the (i) communication network may be predicted, and a comparator arranged in a value since (ii) each ** so that results may be achieved as compared with at least one threshold may be included.

[0009] according to invention of the 3rd of this invention, including computer system for this invention to manage some (i) communication networks [at least], the computer system is constituted so that a prediction machine arranged so that a future value of two or more sequences of time series of data about the (i) communication network may be predicted, and a comparator arranged so that a value may be compared with at least 1 threshold since (ii) each ** and results may be achieved may be included.

[0010] This invention can predict prospective worth of audio traffic level [data in a customer's virtual private network, an image, or], and has an advantage which can judge whether criteria bandwidth level (for example, service level criteria) is exceeded. Therefore, a customer can take action, before exceeding reference level. For example, this action is action of preventing excess use of a communication network or requesting an additional resource to a service provider. Moreover, a service provider knows in advance that reference level may exceed, analyzes a network in advance, and has an advantage which can investigate whether assignment of additional bandwidth is possible. By it, presentation of sale of additional bandwidth of this service provider is attained to a customer. When similarly criteria bandwidth level is smaller than level which a customer uses, both can use this information similarly.

[0011] Preferably, including computer system with which each agent supplies at least one communication link to other agents including at least two agents in this above-mentioned communication network, that computer system is arranged so that a comparison result may be accepted, and it is constituted so that a threshold, criteria of a lot, and information about action of a lot may be included further.

[0012] Moreover, preferably, the (i) agent is used for this invention and it determines the 2nd threshold based on a group of a comparison result, the 1st threshold, and each agent's criteria, and a group of action, and it is constituted so that the 1st threshold of (ii) and the 2nd threshold may be replaced.

[0013] An agent has an advantage which can use a prediction result, for example, can renegotiate a resource through service level criteria for a customer and a service provider. This is simplified and efficient and high use of cost effectiveness of a virtual private network can perform a customer's network administration activity by it. A forecast of its bandwidth level is obtained, for example, a customer's agent uses this information automatically for a customer, and a customer renegotiates service level criteria. Moreover, it is simplified and efficient and high use of cost effectiveness of a communication network resource can perform a service provider's network administration activity. Same method is usable by adjusting action and criteria of a customer's agent's lot by class of various customers who have a different demand and a different priority. Similarly, a service provider's agent can also change.

[0014]

[Embodiment of the Invention] The gestalt of operation of this invention explains only the example below. Although it is the method which was most suitable for these examples putting in practical use this invention which the applicant knows, this invention is not restricted to these examples.

restricted to these examples.
[0015] Drawing 1 is drawing having shown roughly the event sequence generated in the method of managing a customer network. Information 10, 11, and 12 is inputted into the prediction machine 13. Prediction machines of other classes, such as a neural network, a statistics system, or a linear prediction machine, are sufficient as this prediction machine. The information input to this prediction machine includes the hysteresis value of the time series 10 at many times of the past, for example, the traffic level of a communication network. Moreover, although the input of this information 11 and 12 is not indispensable, the current value 11 of time series may be supplied with the event variable 12. The example of an event variable includes current time, a current day of the week, and the current moon.
[0016] A time series prediction value, for example, prediction traffic level, is an output from a prediction machine, and it is shown by the dotted line 20 in drawing 1 . Traffic level can be predicted to network administration and is a mere example of usable measured value of operation. Other examples contain hand off call origination, busy-hour call origination, and an omission call (or cel). Moreover, the hysteresis value of time series 21 is shown in drawing 1 . Traffic level is shown to drawing 1 by the graph of traffic level or the operating bandwidth 15 to time amount 14. This time is set to 17. A line 16 is a peak of bandwidth to which use is permitted for the customer on its virtual private network by expressing a threshold, and is set up on the service level criteria between a customer, a network provider, or an operator. Prediction traffic level is over a threshold during a period 18. This customer has the warning period 19, before prediction for which traffic level exceeds a threshold is performed. Moreover, the information about the amount of excess can also be used.
[0017] The information about between the amount of excess and an excess nascent state is given by using the result of a prediction machine at the time of excess generating. A customer, and a network operator / service provider can also use this information, and a network operator / service provider can take action based on this information after that.
[0018] Moreover, the information on other can be predicted and this can also be used for customer network administration. This information is a factor about the quality of services, such as a parameter measured by the exchange all over a network including a jitter, delay, etc. The grade of service can also be predicted. Moreover, this system can predict when reference level is exceeded or when use of the network resource of other types exceeds capacity or reference level.
[0019] As explained previously, a "virtual private network" is often supplied to some customers who use a service provider's network in large quantities. A customer can control now a part of for example, a service provider's network by this under service level criteria. Typically, these service level criteria specify the bandwidth level on which use is permitted to a customer (others are the same as that of a factor). When a customer exceeds this bandwidth level (or other factors) (violation), data "is canceled" as a matter of fact. Or other penal regulations generate forfeit payment etc. A term "a virtual private network" means the communication network used and controlled by a customer or other entities, and this is some large scale communication networks controlled by the service provider or other entities. A virtual private network is an example of a customer network. A term "customer network administration" means the mutual actuation between the operator relevant to management of some sides an operator's network, and a customer. A term "some communication networks [at least]" means a virtual private network.
[0020] Drawing 2 is drawing showing an example of the network operator (service provider) who provides a customer with Asynchronous Transfer Mode (ATM) virtual private network (VPN) service. A customer uses service of voice 204, data 205, and an image 206 among three sites 203 through the virtual network (the whole drawing shows) which operates on an operator's ATM network 201. The amount of traffic included in an operator's network is supervised and predicted using an above-mentioned method from VPN connection of a customer.
[0021] The monitor of the amount of network traffic which goes into a network from each customer side at points 207, 208, and 209 is possible for an operator. By this function that can predict prospective need from each connection, both operator and customer have many following advantages.
- An operator can predict the short-term prospective need on a network. By this, before service is affected for an operator or automatic processes (agent etc.) as front preparation, in order to cope with any increments in traffic, reconstruction of a resource is attained.
- An operator becomes detectable about the time of a customer exceeding the reference level of service. Many following results are obtained by notifying a customer about the need predicted and negotiating with a customer, for example.
- An operator can agree with carrying excess traffic at the rate of an extra charge.
- A customer performs lock out or re-schedule of an activity, and can determine reduction of the traffic between sites.
- Excess traffic can be blockaded in order to prevent that an operator protects a network increment load and a customer pays a forfeit.
[0022] It is drawing showing how drawing 3 can determine an extra envelope using a prediction machine. Drawing 3 is drawing showing the graph of the bandwidth 302 to time amount 301. A line 303 shows the threshold of the bandwidth set up for example, on service level criteria. a continuous line 307 -- the actual condition -- or the recorded traffic or bandwidth level is shown and a dotted line 308 shows the traffic or bandwidth level predicted. A period 305 shows the past period, a point 304 shows this time and a period 306 shows a future period. 309 shows an extra envelope. This is the field surrounded with the prediction traffic level curve and the threshold. : as which the following information is specified by specifying this excess envelope 309, prediction of when need exceeds capacity, prediction of the degree of the excess predicted, prediction of when need becomes smaller than capacity.
[0023] As an example, the trend analysis apparatus of the neural network base which has been stated to the United States Patent application numbers 08/869900 by application of Northern Telecom can be used for the prediction machine 13. On the whole, all the specifications of the United States Patent application numbers 08/869900, attachment data, a drawing, and a text including an example are contained in this application specification as reference. The information included there forms the indispensable portion of this application.
[0024] It describes below how such a trend analysis apparatus is used and forms one portion of a customer network management system.
[0025] This trend analysis apparatus is trained so that the history log of network traffic may be used, and it can learn now the behavior pattern of network traffic with which a neural network is expected. Once it is trained, a trend analysis apparatus can predict prospective traffic need based on the traffic by which is displayed on a user in drawing and the current monitor is carried out.

traffic need based on the traffic by which is displayed on a user in drawing and the current monitor is carried out.
[0026] This managerial system is divided into four components.
- Common object request broker architecture (CORBA) server. This offers the disperser style for trend analysis features used as a nucleus.
- Operational administration client. This enables a setup and management of a server.
- Prediction client. This performs the monitor and demand of prediction of network traffic.
- Prediction graphing equipment. This displays the network traffic to which monitor and prediction are performed on a graph.
[0027] A trend analysis apparatus CORBA server encapsulates the trend analysis engine which offers a trend analysis feature with the defined CORBA interface description language (IDL) interface (refer to drawing 4).
[0028] Many advantages are acquired by encapsulating the trend analysis engine of an ORBA interface.
- Distribution. This trend analysis apparatus server can operate on a separate machine from client application (for example, a customer's computer system).
- Language independence. Client application may be described in the various language which became independent of server mounting containing C, C++, Small-talk, and Java. An operational administration client is CORBA defined. An IDL interface is used and a trend analysis apparatus server is made to perform creation of the example of a trend analysis engine, training, re-training, exchange, and deletion.
[0029] The purpose of a prediction client is CORBA which supervises the network traffic on network connection, for example, is defined. It is in receiving the prospective level of the network traffic which uses an IDL interface, and shows a trend analysis apparatus this information, and is predicted.
- AddInputPresentation() : pass the present level of network traffic to a trend analysis apparatus. This information is used with a trend analysis engine, and prediction of a prospective traffic pattern is performed.
- MakePrediction() : request a trend analysis apparatus and predict the network traffic to the period of the following predetermined number. As for current and the network traffic predicted to the connection, log record is performed to a file. The display of this file to an operator and a customer is attained in the form of a graph after that, or a prediction client can deliver prediction need to an automatic executive process (for example, agent).
[0030] Prediction graphing equipment is used in order to display the performance log created by the prediction client. This graph displays the actually supervised network traffic with before and a future traffic forecast.
[0031] Then, this component is unified by HP OpenView Network Node Manager.
[0032] This prediction client is the Daemon process corresponding to HP OpenView currently controlled by the ovmpmd (speed excess mode) background process-monitoring program. The performance datas for the connection on equipment are collected through SNMP. The supervised engine performance is used, and prediction comes to hand from a trend analysis apparatus server, and is stored in a file.

[0033] This operational administration client has the Tcl/Tk interface started from an OpenView Windows menu bar, and an operator can re-train it, when the accuracy of a trend analysis apparatus falls.
[0034] It dissociates from HP OpenView and a trend analysis apparatus CORBA server can operate by the machine different from a HP OpenView server.
[0035] An agent can use it, the information, for example, the predicted excess envelope, from this prediction machine. A term "an agent" means the computer system which provides other agents with at least one communication link, and the above-mentioned computer system is arranged so that a comparison result may be accepted, and it includes the information about a threshold, the criteria of a lot, and action of a lot further. This agent acts for a customer, and when required, he negotiates for new service level criteria (for example, when an excess envelope is predicted). An agent negotiates with other one agent at least, and acts for a service provider or a network operator.
[0036] Agents are various abstract level, and since an agent needs negotiation, they have the negotiation model which expresses all negotiation processes to the class of action which should be performed during negotiation. A negotiation model includes the criteria of a lot, and action of a lot.
[0037] The example of criteria includes "decision is more important for service timing than service costs", "it agreeing with service details, before continuing the details of service criteria", "all demands that can be performed being accepted", "only the demand which brings about material gain being accepted", "criteria being refused before a reverse proposal (counter proposal) is set to 5", etc. An agent can choose between the criteria based on the contents of negotiation, and can also choose into the same negotiation.
[0038] As an example of action, there are CAN-DO, PROPOSE, COUNTER-PROPOSE, ACCEPT, REJECT, etc.
[0039] The following three main elements are included as an example of a negotiation model.
1. Data structure showing negotiation result.
2. Negotiation protocol.
3. Reason attachment model.
[0040] The data structure showing criteria is called service level criteria (SLA). An agent negotiates mutually about service. Each service has the linkage group of various attributes from the meta-details of high level, such as a price, quality, and start time, to the details of lows, such as a required output inputted or demanded. An agent exchanges this SLA proposal (proposal) by negotiation until he accepts SLA of specification [either of both] or one side or both refuse him. Last SLA acquires and displays a virtual private network etc. for the criteria about these attributes that define the conditions for offering service among agents.
[0041] An agent communicates using a negotiation protocol. For example, this is the group to which voice actuation types, such as CAN-DO, PROPOSE, COUNTER-PROPOSE, ACCEPT, and REJECT, were limited.
[0042] The reason of the agent about a proposal and acceptance of a reverse proposal, refusal, or generating is displayed with a negotiation model. This model is performed using the declarative type knowledge base (KB) and the two knowledge bases of procedural KB. The declarative type KB with which it is expressed as a network which shows a cause expresses clearly the model of for what it negotiated, or for what purpose negotiation is performed. For example, the negotiation about the price of service is

for what it negotiated, or for what purpose negotiation is performed. For example, the negotiation about the price of service is metaservice contention, and this contention is generated according to either of the facts that the agent who pays very many courtesy rates, or the agent whose agents are others can guess a rich thing. procedural [which is expressed as the strategy or criteria of a lot] -- if KB has this declarative type knowledge, it specifies the group of the action performed. For example, when there is knowledge that an agent needs to be negotiated about a price, an agent can adopt the strategy accompanied by creation of price presentation, and continuation of the reverse proposal of initial presentation. Other strategic examples are the argument strategies in which the agent's of an associate negotiation action is reproduced.

[0043] When an intellectual agent is used, there are many advantages as follows.

- A system designer can abstract a problem solving in a high-level term, focuss in the easy term for the complicated problem of an interaction, and can create a further more complicated maintainable solution appropriately.
- New action becomes easy, when an interaction, relation, and organization occur as a result, depend and develop using an efficient solution.
- Bigger distribution than that of a network administration function is attained.
- The system integration of the of a different kind and conventional (network administration) becomes possible.
- The communication system which an intellectual agent manages has responsibility more, and can cope with scalability and an engine-performance problem.
- The communication system which an intellectual agent manages is supple, is dynamic and can make easy the network services "according to a demand" (on demand).
- The communication system which an intellectual agent manages can cope with the complexity (both an operator and a customer) of a network administration function, and the increment in a priority.

[0044] Especially an intellectual agent's use is effective at the following communication system.

- Or there is no centralized control, the reliability of centralized control is low and it is not structural.
- A system is built by completely different design principle, and is different species as a matter of fact.
- A standard interface is not actually used but a possibility of being used is low.
- Complicated negotiation or the adaptability of an interface needs [an interface] flexibility or is required.
- Development of the large-scale and complicated conventional system already exists, and being demanded is encapsulating such a system to opening more.
- Since the interface demand is complicated, simple client-server architecture is impossible (for example, when more complicated adaptability is required).

[0045] Appendix TAPredictionTAPrediction includes a forecast and related time amount.

TAPrediction: : GetPredictionValuefloatGetPredictionValue()const; (notes) prediction is returned.

TAPrediction: : GetTimePredictionIsForTime GetPredictionIsFor()const; (notes) the time amount relevant to prediction is returned.

DTDataSetSpecificationDTDataSetSpecification is a location holder required for data conversion performed in TA for structure information.

DTDataSetSpecification::DTDataSetSpecificationDTDataSetSpecification(int-no_of_ts-input-values, int no of-ancillary-values, Bool month, Bool day of week, Bool hour, Bool minute, IncrementIntervalType increment interval, int increment step, int-no-ofintervals to output, float normalisation upper bound, float normalisation lower bound;no ts input values : This is the number of the values of the past of a location survey beforehand. This typical value is 4. This value must be equal to recall window size in TA spec.

no of ancillary values: This is the numbers of inputs other than the time amount of the amount of prediction which influences prediction, and the past value. This value must be equal to number of ancillary values in TA spec.

Month: It is the Boolean value which shows whether data changes with lunar periodicity.

day of week: This is a Boolean value which shows whether data changes a week period.

hour: This is a Boolean value which shows whether data changes by the time period.

minute: This is a Boolean value which shows whether data changes by the time period.

increment interval: This tells an engine about which gap increments (example; second).

increment step: This shows which increments a gap or how much it increments in an engine combining this parameter and increment interval about which an engine is told (example; 30) to an engine.

normalisation upper bound: Since it is automatically set in training / re-training phase, set this value to 0.0.

normalisation lower bound: Since it is automatically set in training / re-training phase, set this value to 0.0.

DTDataSetSpecification: It : Is the countable type which takes the value below IncrementIntervalType.

enum IncrementIntervalType{MONTH, DAY, DAY IN WEEK, HOUR, MINUTE};DTDataSetDTDataSet supplies the receptacle for training data which TA is made to pass and which is right format. The group of this data must have at least one line, as shown in drawing 5 .

DTDataSet: : DTDataSetDataSet();DTDataSet(List of_p<DTRow>*rows);rows: It is a list of line pointers.

(Note) A data group is generated.

DTDataSet: : LinkR18HasLinkR18Has(DTRRow*rows id) rows id: A line pointer is shown.

(Note) A line is added to the group of data.

DTRowDTRow offers the receptacle about related information. That is, as shown in drawing 6 , time amount is combinable with data and an auxiliary adjustable value in a line. Many both lines are combinable in the group of data.

DTRow: : DTRowDTRow()DTRow(int row number) row number: It is a line number in a data group.

(Note) A line is generated.

DTRow: : LinkR5IscomposedOfLinkR5IscomposedOf(DTDataItem*data item id) data item id: Add the pointer (notes) data item to a data item to a line. A data item is added to a line in specific sequence. A date and a time data item always come at the beginning of No. 1 of a line. Next, one data item which predicts comes. Finally, a user can add an auxiliary variable-data item as he is required. Refer to DTDataItem.

DTDataItem.
DTDataItem<TXF FR=0001 HE=250 WI=080 LX=0200 LY=0300>DTDataItem is a location holder for data. Either a date and a hour entry, or one data value is OK as data. Many data items are combinable in a party. Refer to DTRow.
DTDataItem: : DTDataItemDTDataItem(Time*time values, int column_number) DTDataItem(float numeric_value, int column_number) time values: A date and a hour entry.
numeric value: A 1 ** data value. column number: The location under data item list.
(Note) A data item is generated.
NNNeuralnetworkCreationSpecNNNeuralnetworkCreationSpec is a location holder holding the information included in the neural network element. Drawing 7 shows the neural network generation spec. relevant to other two objects with the necessity of being constituted first. These two objects are layered network spec. and network training spec.
NeuralnetworkCreationSpecNNNeuralnetworkCreationSpec(NNNeuralnetworkCreationSpec*network spec id, NNNetworkTrainerSpec*trainer spec id) network spec id: It is a pointer to network spec.
trainer spec id: It is a pointer to training spec.
(Note) NNNeuralnetworkCreationSpec is generated.
NNNeuralnetworkSpecNNNeuralnetworkSpec is a supertype object for an escape which supports the neural network of other types. NNLayeredNetworkSpec is a subtype and may substitute with Object NNNeuralnetworkSpec. NNLayeredNetworkSpec layered network spec. has two configurations. The array of a weighting value can be supplied (as opposed to the trained spec.), or it can call without a weight value (as opposed to the spec. which is not trained).
NNLayeredNetworkSpec: : List [of NNLayeredNetworkSpecNNLayeredNetworkSpec(Lis<int>&unit_mumbers);NNLayeredNetworkSpec(Lis<int>&unit_mumbers, SWAArray&weights);unit_mumbers:3 integral values] - The number of units in an input layer. This number is determined by the number of the values of the past of the amount to predict, the changing time interval, and the number of auxiliary adjustable values.
- It hides and is the number of units in a layer. This number is determined by topology optimization.
- The number of units in an output layer. This is set to 1.
weights: This is the value of each weighting during association in a neural network. This value is set up at the time of training / re-training. If the trained spec. passes, it is necessary to carry out weighting. Weighting will be unnecessary if the spec. of TA which is not trained passes.
NNNetworkTrainerSpec network training spec. is a location holder for information contained in a neural network training element.
NNNetworkTrainerSpec::NNNetworkTrainerSpecNNNetworkTrainerSpec(float target error, unsigned int percentage validation, Bool is early-stopping-required, unsigned-int-number of training cycles, long random seed, unsigned int max number of steps, floatfractional tolerance;target error - this It is the condition precedent for TA training measured on training data.
- A zero value stops this test. 0 is the usual value.
- A non-zero value gives the error value which stops training (when training has not stopped by other reasons before).
It is important only when it is percentage validation:is early stopping required=TRUE. The rate of training data is chosen at random as an effective data, therefore is not used for optimization.
is It is the Boolean value which shows whether it should be used for generalization of the neural network technology of early stopping required:early stopping. In almost all cases, this is set to TRUE.
number of training cycles: The count which reinitialization of the TA is carried out in order to find the optimal solution, and is training-ized.
- A zero value requires re-training. That is, it is 1 time of the training cycle started from a former weighting value.
- A non-zero value shows the count of the training cycle to perform. Weighting is carried out at random at the beginning of each training cycle. The network which returned is the optimal training cycle.
random seed: This initializes weighting and controls the kind of the pseudo-random student machine of several shots used in order to choose an effective group.
- In the value of -1, a radionuclide generator uses as a seed the value drawn from the system clock. If it carries out like this, un-predicting-ization will be made into max for the number generated. With this parameter, -1 is the usual value.
- A positive number is changed into unsigned int and this (example; it reduces to 32 bits) value is used for it as a seed. This option is used for the purpose, such as regression testing and debugging, when the sequence with the same pseudo-random number is needed each time.
max number of steps: This is other conditions of suspending training, in order to restrict the count of renewal of TA.
- A zero value stops this test. This parameter is usually zero.
- A non-zero value supplies the number of steps which stops a training cycle (when having not stopped by other reasons before).
fractional tolerance: When a step does not show more than this and an extensive improvement, an optimization machine stops (when having not stopped by other reasons before).
- A zero value is judged that this step is not important when it becomes small as compared with the accuracy of floating point count. The adaptation level performed on these criteria does not deserve the excessive time amount for which optimization is needed.
- A relative improvement required to judge that a step is important for a non-zero value is shown. This may be used as a quite simple method for shortening time amount required for optimization, without making a practical difference compared with the case of adaptation. The value to 10-2 to 10-6 is recommended to this value as an experiment start point.

[redacted]

[Translation done.]

DESCRIPTION OF DRAWINGS

[redacted]

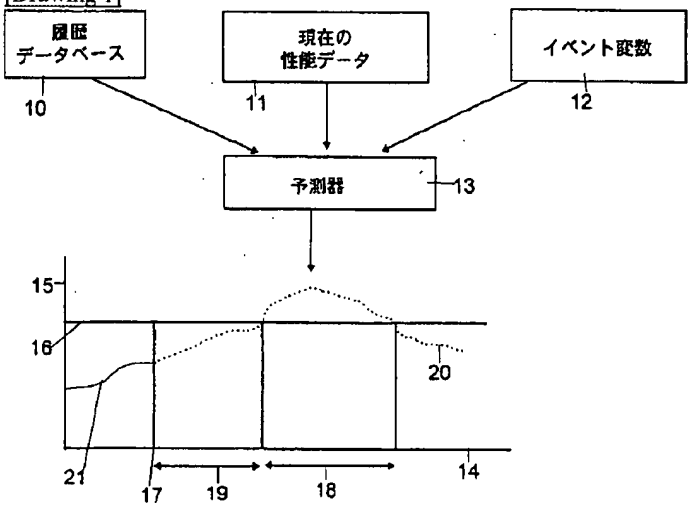
[Brief Description of the Drawings]
[Drawing 1] It is the schematic diagram showing the event sequence performed in the customer network administration method.
[Drawing 2] It is the schematic diagram in which a customer shows voice, data, and the communication network that is offering service of an image among 3 sites on the virtual network offered by the network operator.
[Drawing 3] It is drawing showing the graph of the bandwidth to the time amount which shows the actual engine performance, predictability ability, and the prediction envelope for an excess.
[Drawing 4] It is drawing showing the example of the trend analysis apparatus CORBA server IDL.
[Drawing 5] It is drawing showing DTDataSet and Relation DTRow.
[Drawing 6] It is drawing showing DTRow and Relation DTDatItem.
[Drawing 7] It is drawing showing neural network generation spec. and a related object.
[Description of Notations]
10 -- Hysteresis value of time series
11 -- Current value of time series
12 -- Event variable
13 -- Prediction machine
201 -- An operator's ATM network
203 -- Three sites on a virtual network

[redacted]

[Translation done.]

DRAWINGS

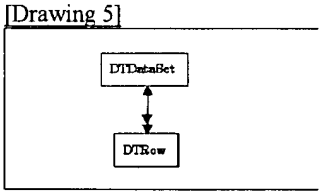
[Drawing 1]



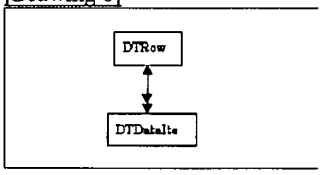
[Drawing 4]

```
interface SSETrendsAnalysisEngine
{
void createTrendsAnalyser(
  in SSETATASpecification ta_spec_id)
  raises (SSEExceptionRaised);

oneway void trainTrendsAnalyser(
  in SSEDTDataSet training_data_set_id);

void addInputPresentation(
  in SSETASinglePresentation new_data)
raises (SSEExceptionRaised);

void makePrediction(
  in short number_of_recursions)
  raises (SSEExceptionRaised);

void switchPredictor ()
  raises (SSEExcptionRaised);

void deleteTrendsAnalyser()
  raises (SSEExceptionRaised);
}
```

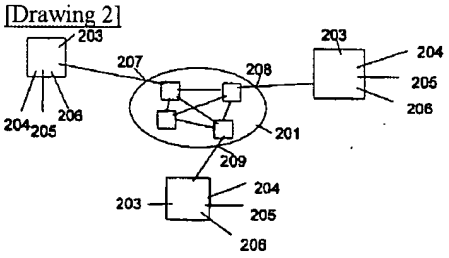
[Drawing 5]



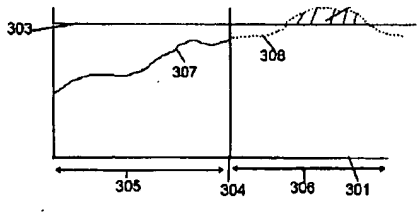
[Drawing 6]



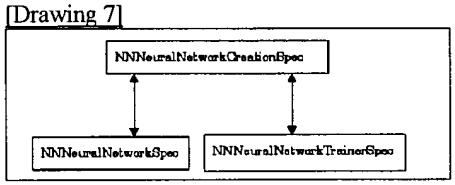
[Drawing 2]



[Drawing 3]



[Drawing 7]



[redacted]

[Translation done.]